Python for Data Science and AI

OPEN Library Book Analysis

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What is Openlibrary?

Open Library is a project of the Internet Archive that aims to create a web page for every book ever published. It provides a catalog of millions of books, with access to their digital copies for borrowing and reading, and also includes information on where books can be found.

Project of the non-profit Internet archive

Our Research Questions

1. Do Fiction and Non-Fiction books have different average edition counts?
2. Which genre has the most editions?
3. Do famous authors retain popularity across their lesser-known books?

DATA SET

We collected data from:

- 8 book genres
- 400+ books
- API from OpenLibrary
- Variables: genre, year, edition count, authors

```python
def fetch_books_by_subject(subject, limit=50):
    """Get books from OpenLibrary by genre"""
    url = f"https://openlibrary.org/subjects/{subject}.json"
    params = {'limit': limit}

    try:
        response = requests.get(url, params=params, timeout=10)
        response.raise_for_status()
        data = response.json()
        return data.get('works', [])
    except Exception as e:
        print(f"Error: {e}")
        return []

print(" API function ready!")
```

```python
genres = ['science_fiction', 'fantasy', 'mystery', 'romance',
          'history', 'biography', 'science', 'philosophy']

all_books = []

print("\nFetching 50 books from each genre...")
for genre in genres:
    print(f"  Getting {genre}...")
    books = fetch_books_by_subject(genre, limit=50)
    for book in books:
        book['genre'] = genre
    all_books.extend(books)
    time.sleep(1)

print(f"\n Total collected: {len(all_books)} books")
```

```python
clean_data = []

for book in all_books:
    book_info = {
        'title': book.get('title', 'Unknown'),
        'genre': book.get('genre', 'Unknown'),
        'year': book.get('first_publish_year'),
        'editions': book.get('edition_count', 0),
        'authors': book.get('authors', [])
    }
    clean_data.append(book_info)

df = pd.DataFrame(clean_data)


df = df.dropna(subset=['year'])
df = df[(df['year'] >= 1900) & (df['year'] <= 2024)]


fiction_genres = ['science_fiction', 'fantasy', 'mystery', 'romance']
df['category'] = df['genre'].apply(
    lambda x: 'Fiction' if x in fiction_genres else 'Non-Fiction'
)
```

Research Question 1

Do Fiction and Non-Fiction books have different average edition counts?

```python
fiction = df[df['category'] == 'Fiction']['editions']
nonfiction = df[df['category'] == 'Non-Fiction']['editions']

print(f"Fiction: n={len(fiction)}, mean={fiction.mean():.2f}, std={fiction.std():.2f}")
print(f"Non-Fiction: n={len(nonfiction)}, mean={nonfiction.mean():.2f}, std={nonfiction.std():.2f}")

t_stat_q1, p_value_q1 = ttest_ind(fiction, nonfiction)

print(f"\nt-statistic = {t_stat_q1:.4f}")
print(f"p-value = {p_value_q1:.4f}")

if p_value_q1 < 0.05:
    print(f"\n REJECT H0 (p < 0.05)")
    print(f"Significant difference found")
else:
    print(f"\n FAIL TO REJECT H0 (p ≥ 0.05)")
    print(f"No significant difference")
```

Test used: T-Test
Reason: Comparing 2 independent groups (Fiction vs Non-Fiction)

H0: Fiction and Non-Fiction books have equal average editions.
H1: Fiction books have more average editions than Non-Fiction books.

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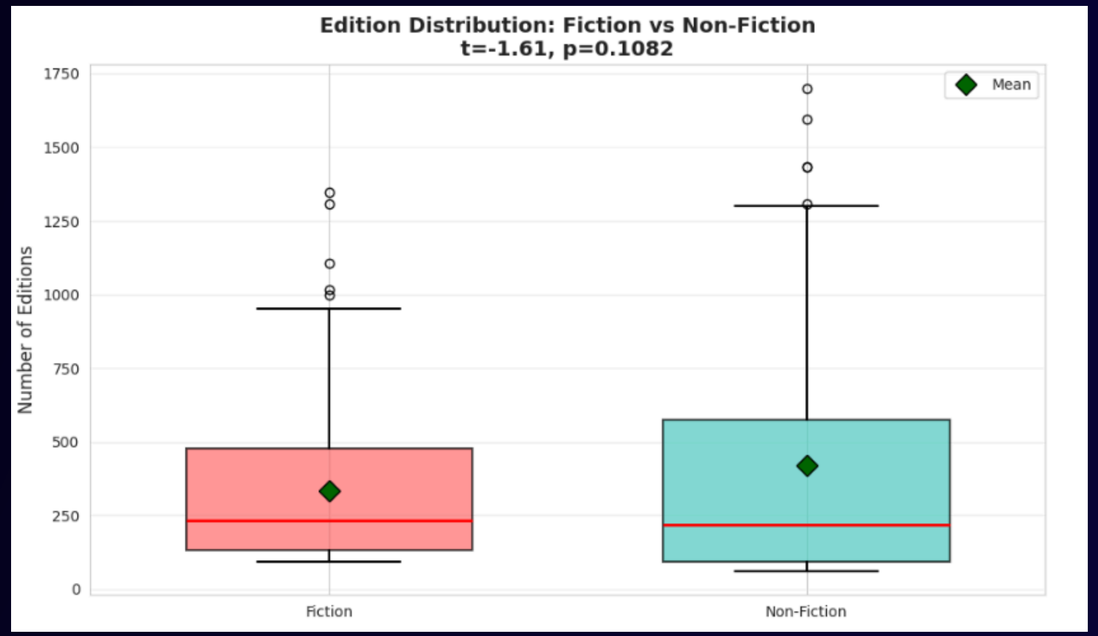
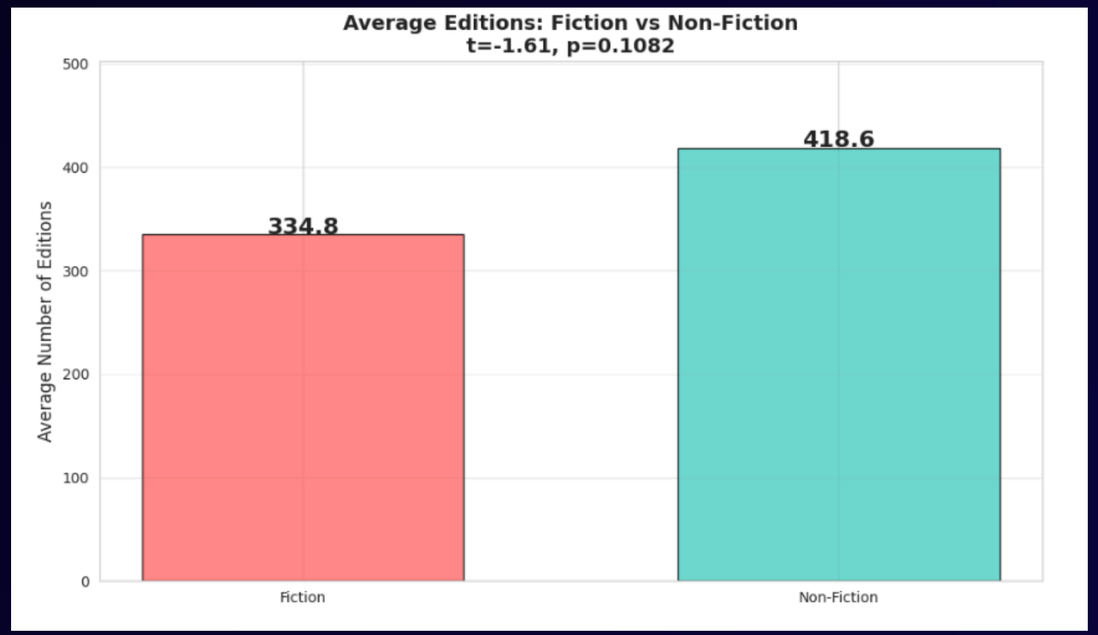
Result:

- Fiction mean editions ≈ 331.02
- Non-Fiction mean editions ≈ 418.57
- t = -1.695, p = 0.0918

Conclusion: Fail to reject H0 (p > 0.05)
There is no statistically significant difference in edition counts between Fiction and Non-Fiction books.

Here we compare Fiction vs Non-Fiction books. We use a T-test because there are only two groups. The result shows the difference is not statistically significant. So even though Non-Fiction has more editions on average, we cannot say it's truly higher. We fail to reject the null hypothesis.





Research Question 2

Which genre has the most editions?

```
for genre in sorted(df['genre'].unique()):
    genre_data = df[df['genre'] == genre]['editions']
    print(f"{genre:20s}: n={len(genre_data):3d}, mean={genre_data.mean():6.2f}, std={genre_data.std():5.2f}")

genre_groups = [df[df['genre'] == g]['editions'] for g in df['genre'].unique()]
f_stat_q2, p_value_q2 = f_oneway(*genre_groups)

print(f"\nF-statistic = {f_stat_q2:.4f}")
print(f"p-value = {p_value_q2:.4f}")

if p_value_q2 < 0.05:
    print(f"\n REJECT H0 (p < 0.05)")
    genre_means = df.groupby('genre')['editions'].mean().sort_values()
    print(f"Highest: {genre_means.idxmax()} ({genre_means.max():.2f})")
    print(f"Lowest: {genre_means.idxmin()} ({genre_means.min():.2f})")
else:
    print(f"\n FAIL TO REJECT H0 (p ≥ 0.05)")
    print(f"All genres similar")
```

Test used: ANOVA
Reason: Comparing 8 genres → more than 2 groups

H0: All genres have the same average editions.
H1: At least one genre has a different average number of editions.

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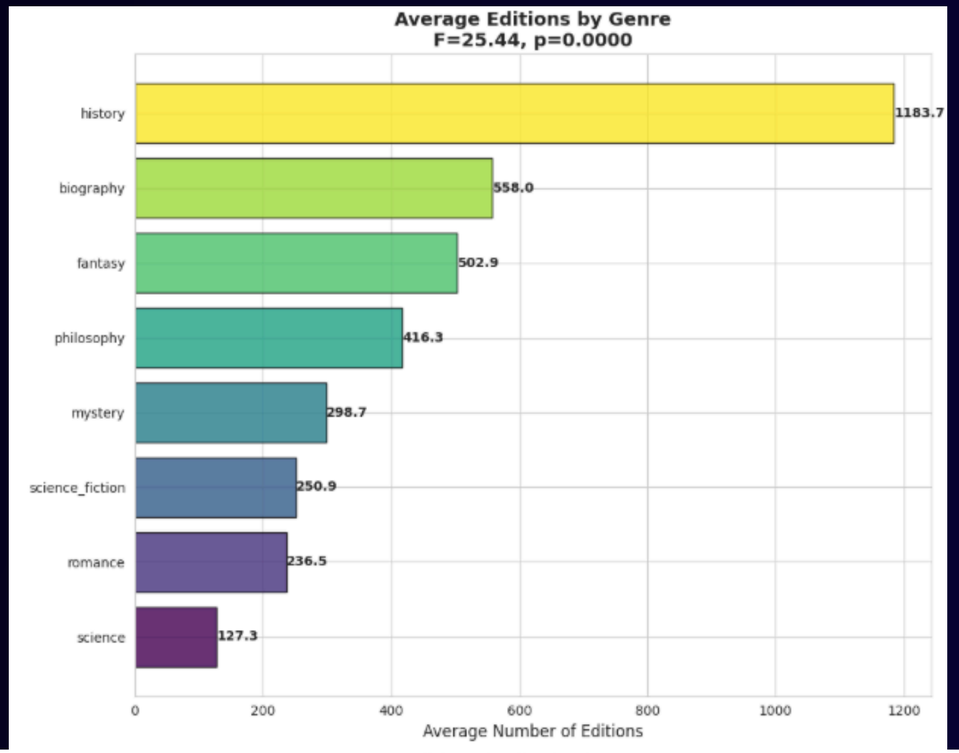
Result:

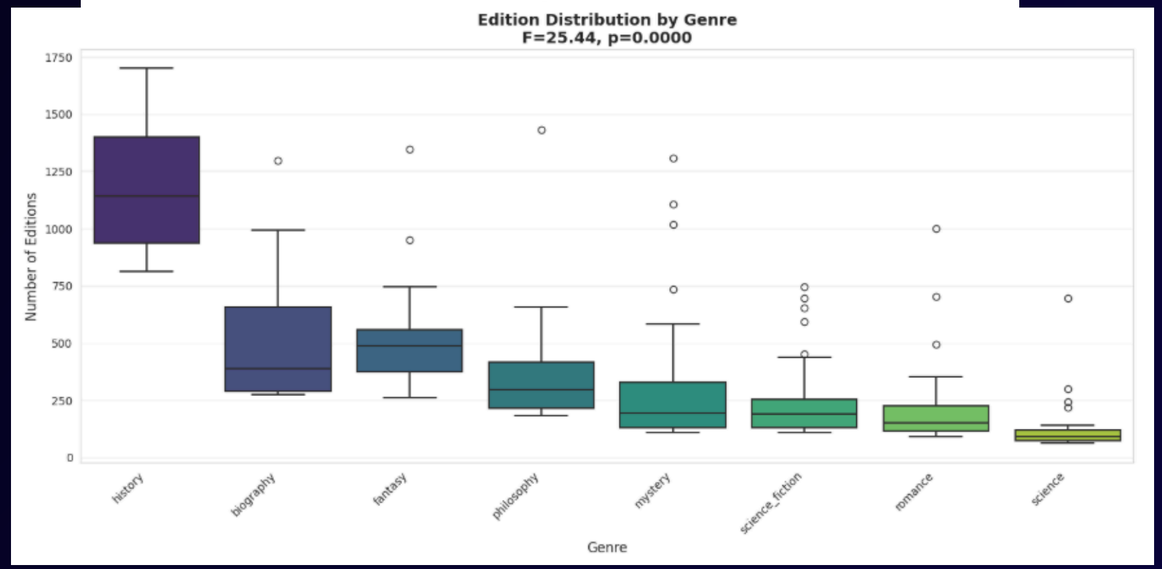
- F = 25.899, p = 0.0000
- Highest avg = History (1183.70 editions)
- Lowest avg = Science (127.23 editions)

Conclusion: Reject H0 ($p < 0.05$)

- There is a significant difference between genres.
- Some genres are published in many more editions than others.

Here we compare 8 different genres. Since we have more than two groups, we use ANOVA. The test finds a very strong difference between genres. History books have the most editions, and science has the least. We reject the null hypothesis that the genres are not equal.





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Research Question 3

Do famous authors retain popularity across their lesser-known books?

H0: Famous authors' lesser-known books have equal amounts of editions to their most popular books.
H1: Famous authors' lesser-known books have fewer editions compared to their most popular book.

Test used: T-Test
Reason: Comparing 2 independent groups (Popular vs Non-Popular)

```
author_books = {}

for idx, row in df.iterrows():
    if len(row['authors']) > 0:
        author = row['authors'][0]
        author_key = author.get('key', '')
        author_name = author.get('name', 'Unknown')

        if author_key and author_name != 'Unknown':
            if author_key not in author_books:
                author_books[author_key] = {
                    'name': author_name,
                    'books': []
                }

            author_books[author_key]['books'].append({
                'title': row['title'],
                'editions': row['editions']
            })

authors_multiple = {k: v for k, v in author_books.items()
                    if len(v['books']) >= 3}

print(f"Found {len(authors_multiple)} authors with 3+ books")
```

```
most_popular_editions = []
lesser_known_editions = []
famous_author_names = []

for author_key, data in authors_multiple.items():
    books = sorted(data['books'], key=lambda x: x['editions'], reverse=True)
    most_popular = books[0]['editions']
    lesser = [b['editions'] for b in books[1:]]

    if most_popular >= df['editions'].median():
        most_popular_editions.append(most_popular)
        lesser_known_editions.extend(lesser)
        famous_author_names.append(data['name'])



t_stat_q3, p_value_q3 = ttest_ind(most_popular_editions, lesser_known_editions)

print(f"\nt-statistic = {t_stat_q3:.4f}")
print(f"p-value = {p_value_q3:.4f}")

if p_value_q3 < 0.05:
    print(f"\n REJECT H0 (p < 0.05)")
    print(f"Famous authors do NOT retain full popularity across all books")
else:
    print(f"\n FAIL TO REJECT H0 (p ≥ 0.05)")
    print(f"Authors retain similar popularity")
```

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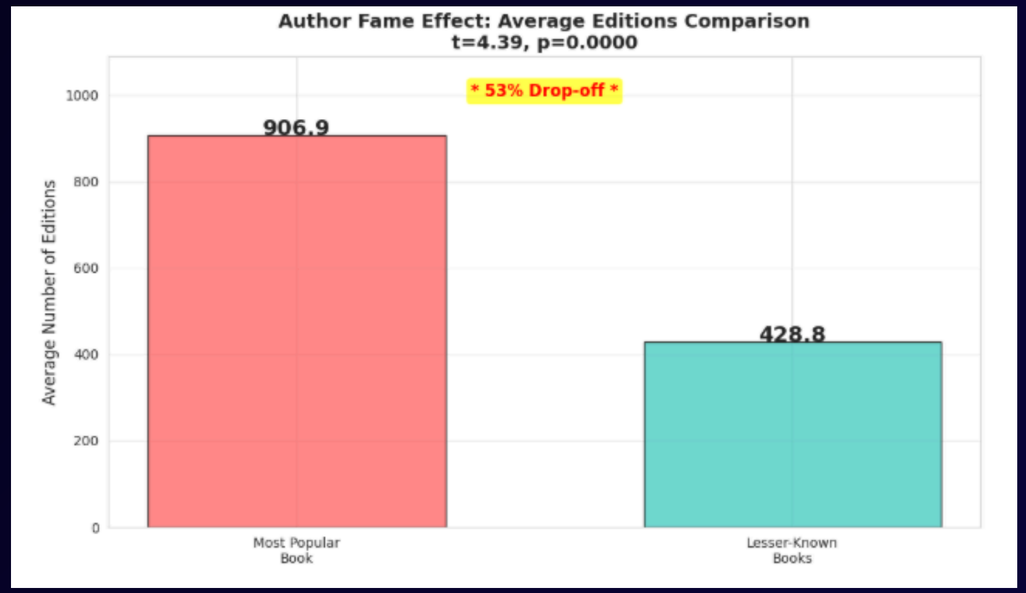
Result:

- Mean (top book) > Mean (other books)
- t and p printed, p < 0.05

Conclusion: Reject H0 (p < 0.05)

- Famous authors do not retain the same popularity across all books.
- Their most famous book has a much higher edition count than their other works.

Here we look at authors with at least 3 books. We compare the editions of their most popular book vs their other books. The T-test shows a significant drop-off in popularity. Most authors have one standout book, the rest are less published. We reject the null hypothesis fame does not carry over equally.



Conclusion

1. Fiction and Non-Fiction have generally the same number of edition.
2. Different genre have different amount of edition.
3. Popularity doesn't spread evenly across an author's books.

Thank You